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THE WEATHER AND CIRCULATION OF FEBRUARY 1970

Continued Mild in the West and Cold in the East

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1. WEATHER SUMMARY

Repeated outbreaks of arctic air kept the eastern half of the Nation several degrees lower than normal; but in much of the West, relatively mild weather prevailed for the seventh consecutive week. The upper level flow pattern of a ridge in the West and a trough in the East was similar to the pattern of the winter season. This high-amplitude flow caused the freezing line to reach the Gulf of Mexico and well into Florida each week this month; the 0°F isotherm went as far south as northern Georgia. New record temperatures for the month included 27°F at Sault Ste. Marie, Mich., and 81°F at Goodland, Kans. The only other records of note came from Lakeland, Fla., with November to February the coldest 4-mo period of record and from the San Francisco, Calif., city office with the warmest December to February of record.

Dryness in the West broke February records at Denver, Colo., Lander, Wyo., Goodland, Kans., and Pocatello, Idaho, because the principal track of storminess carried

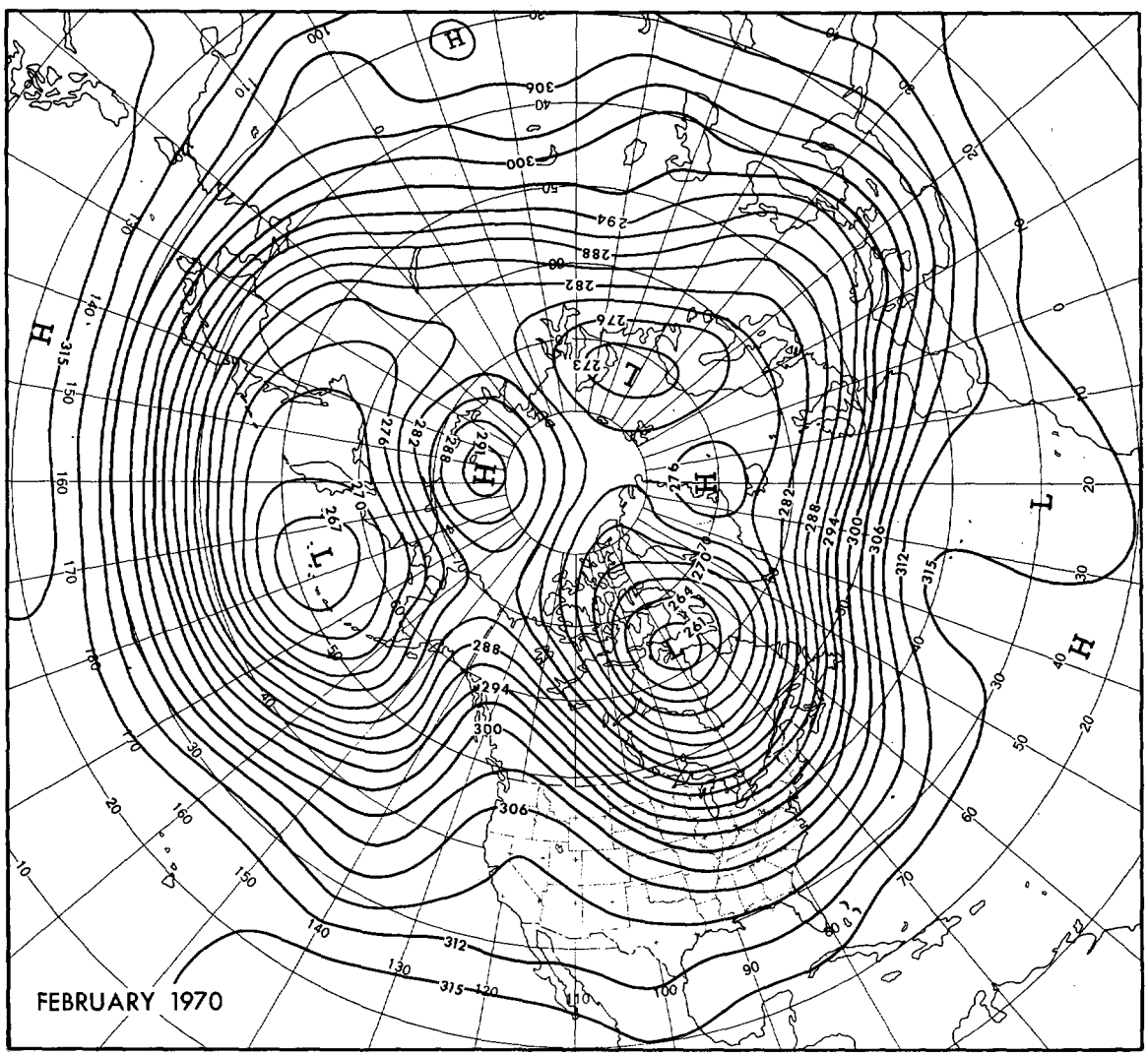


FIGURE 1.—Mean 700-mb contours (decameters) for February 1970.

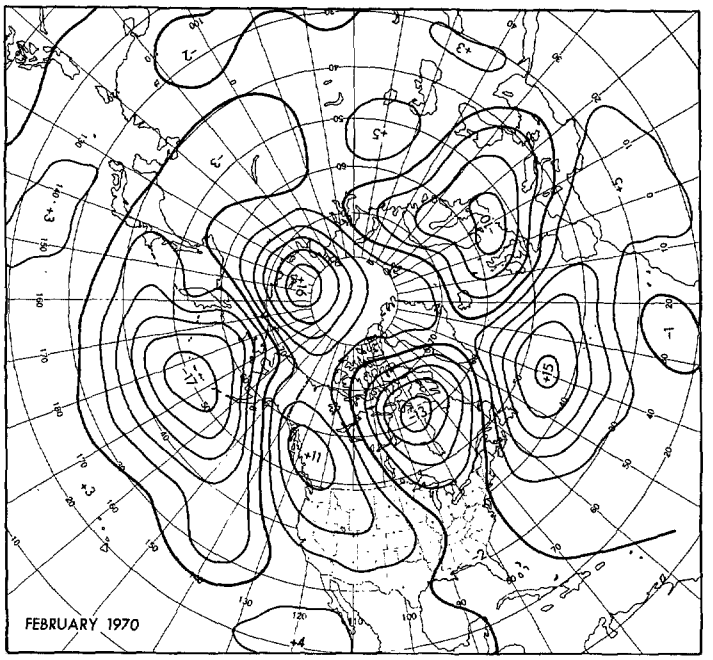


FIGURE 2.—Departure from normal of mean 700-mb height (decameters) for February 1970.

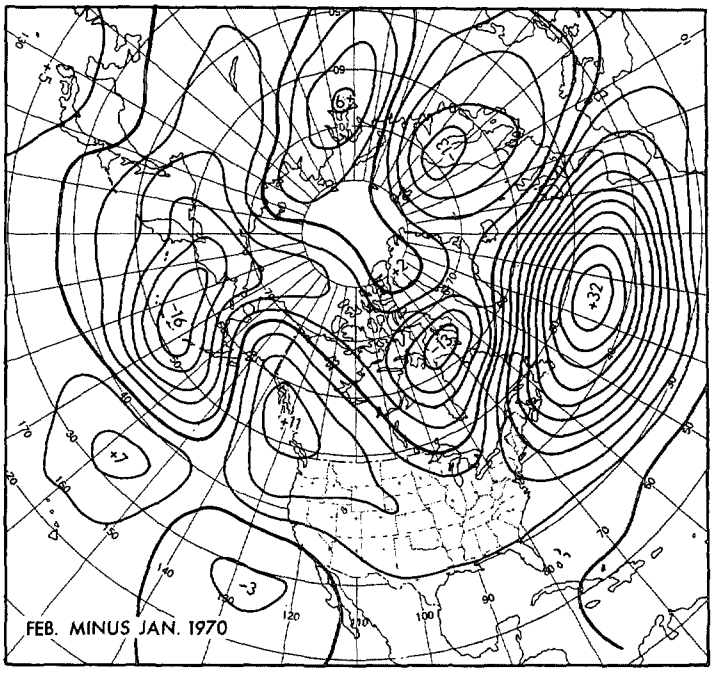


FIGURE 3.—Mean 700-mb height anomaly change (decameters) from January to February 1970.

moisture only from the Gulf of Mexico to New England. A secondary track of storms from western Canada through the Great Lakes produced little precipitation in the United States.

2. MEAN 700-MILLIBAR CIRCULATION

Flow in the midtroposphere in midlatitudes (35°–55° N.) increased from 8.8 m sec $^{-1}$ in January to 11.4 m sec^{-1} in February in the western portion of the Northern Hemisphere. This incease reflected the recovery phase of an index cycle that began in December 1969. Strong westerly flow over the oceans (figs. 1 and 2) contributed most to the above-normal flow because strongly meridional flow dominated North America.

Large changes in the mean 700-mb circulation occurrred in the Atlantic from January to February (fig. 3) as the broad cyclonic flow of January changed to a strong ridge in February that was as much as 160 m above normal. This anticyclogenesis resulted in a maximum increase of 320 m in the 700-mb level in the central Atlantic. The principal 700-mb jet axis (fig. 4) was 10°–15° latitude north of its normal position with the average mean flow 5–10 m sec^{-1} faster than normal between 50° and 60° N. South of 40° N., the mean flow was 5–10 m sec^{-1} slower than normal. The northward displacement of the maximum mean westerlies resulted in a similar northward displacement of the tracks of sea-level Highs and Lows (see charts VIII and IX of Environmental Data Service 1970*a*).

Amplification spread into Europe as the weak blocking of January gave way to a trough that extended from

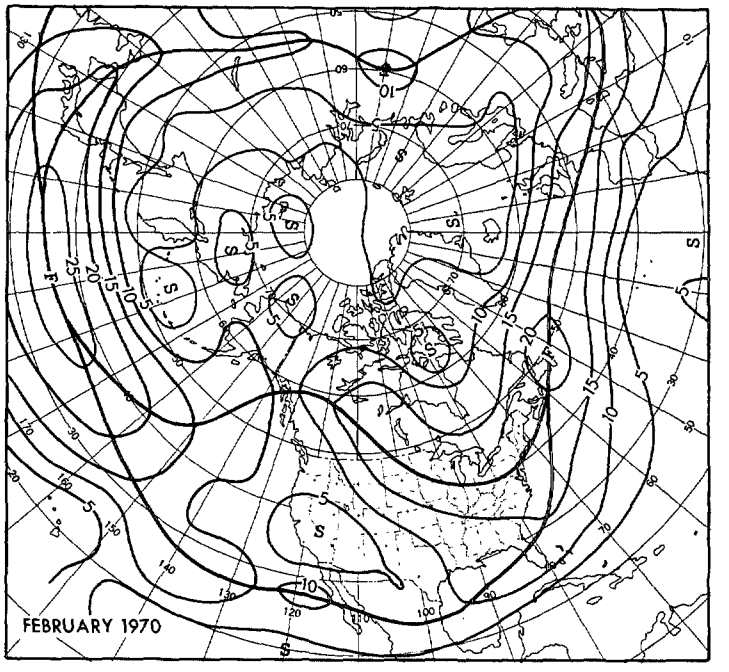


FIGURE 4.—Mean 700-mb isotachs (meters per second) for February 1970. Heavy lines show axes of maximum wind speed.

Novaya Zemlya to the Mediterranean. Maximum negative height departures from normal of about 100 m occurred near Denmark. The 700-mb jet reached the Mediterranean with speeds of 5–10 m sec^{-1} above normal accompanied by some cyclonic activity in southern Europe and the Balkans, but storminess was more frequent north

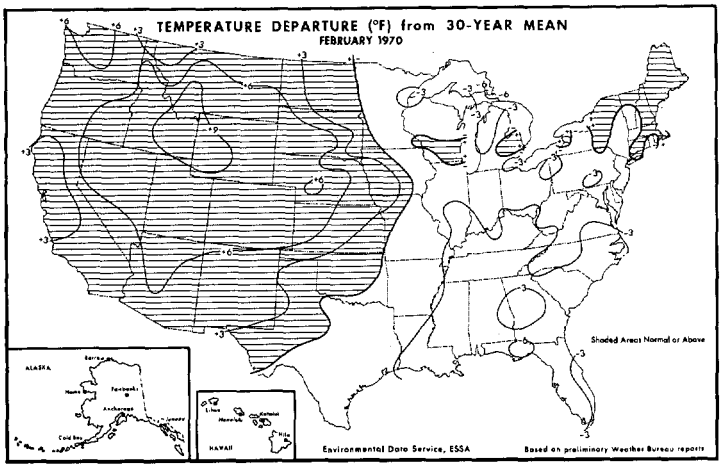


FIGURE 5.—Departure from normal of average surface temperature (°F) for February 1970 (from Environmental Data Service 1970*b*).

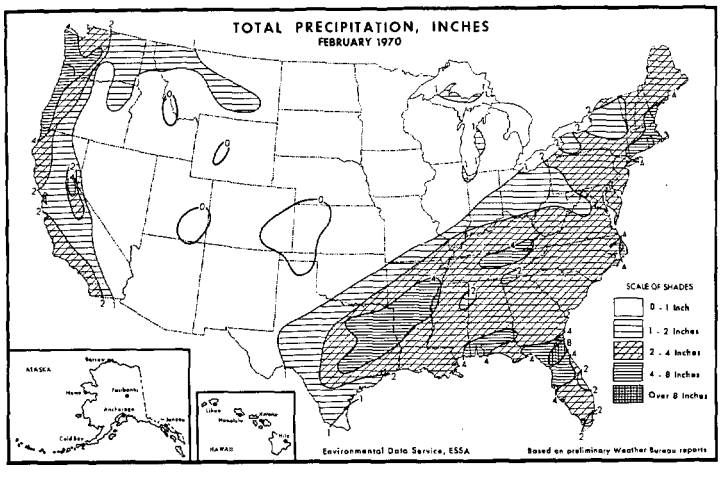


FIGURE 6.—Total precipitation (inches) for February 1970 (from Environmental Data Service 1970*b*).

of 50° N. This amplification failed to produce much cold weather in Europe since maritime air masses prevailed, and 1000–700-mb thickness (not shown) was only slightly less than normal.

Westerly flow dominated Asia with little penetration of cooler than normal air south of 50° N. Strong blocking, the most prominent feature of the Arctic on the Asian side of the North Pole, changed little in position or intensity from January. Above-normal thickness accompanied this block, the strongest center of action (160 m above normal) in the eastern portion of the Northern Hemisphere.

In the Pacific the westerlies, which were 10 m sec^{-1} faster than normal, had a jet maximum of more than 25 m sec^{-1} located about 5° latitude north of normal. The 700-mb trough deepened about 160 m in the Bering Sea as the Low near Kamchatka in January moved to the western Aleutians. The accompanying cyclonic flow extended into the eastern Pacific, manifested as a sharp curvature southeastward from the Aleutians and a mean trough near 140° W. (fig. 1).

In response to the trough in the eastern Pacific, the ridge strengthened over western North America, and heights increased by as much as 110 m along the coast of British Columbia. With the positive height anomaly over British Columbia (fig. 2), lower latitude westerlies crossed the Pacific coast between 20° and 30° N. As the ridge proceeded in western North America and bridged across the Beaufort Sea to the Asian block, the cyclonic center of action over North America deepened from near-normal heights in January to as much as 130 m below normal in February. The meridional flow thus created had a marked influence on the weather over the United States.

3. AVERAGE MONTHLY WEATHER

The strong ridge over western North America this month, with heights above normal from the Mississippi Valley to the west coast, produced mild weather in this area. Temperatures in the Rocky Mountain States averaged 6°–9°F above normal (fig. 5). In the eastern half of the Nation, temperatures were normal to a few degrees below normal, associated with the mean trough that extended from Hudson Bay to the eastern Gulf of Mexico.

High persistence in the temperature anomaly classes from January to February reflect the persistent upper level flow for these 2 mo. Of 100 representative cities in the United States, 59 percent changed by no more than one class. More notable, none of these cities averaged colder relative to normal in February than in January. Most of the warming trend of two or three classes occurred in the area from Montana to Illinois and in the Northeast.

No new monthly mean temperature records were reported, but numerous daily records were established. Most of these were daily maximum temperatures in the 60's over the Rockies and 70's and above in eastern Colorado and western portions of Kansas and Nebraska. In contrast, and consistent with the mean flow, the new daily records east of the Mississippi were generally for minimum temperatures.

Dry weather prevailed this month (fig. 6) over a large portion of the Central and Rocky Mountain States. This was consistent with the mean northwesterly flow west of the mean trough and anticyclonic curvature over most of the West. In the Pacific Coast States, precipitation totaled 1–4 in., but for the most part, this was less than normal despite the mean southwesterly flow aloft. The eastern portion of the Nation reported near-normal precipitation (1–4 in.) from west Texas to Ohio. Excessive precipitation fell in portions of central Texas, northern Florida, and from the mid-Atlantic coast to New England.

4. VARIABILITY IN FEBRUARY

HALF MONTHLY

Mean 700-mb circulation features changed rather slowly this month without large reversals in the flow or in the

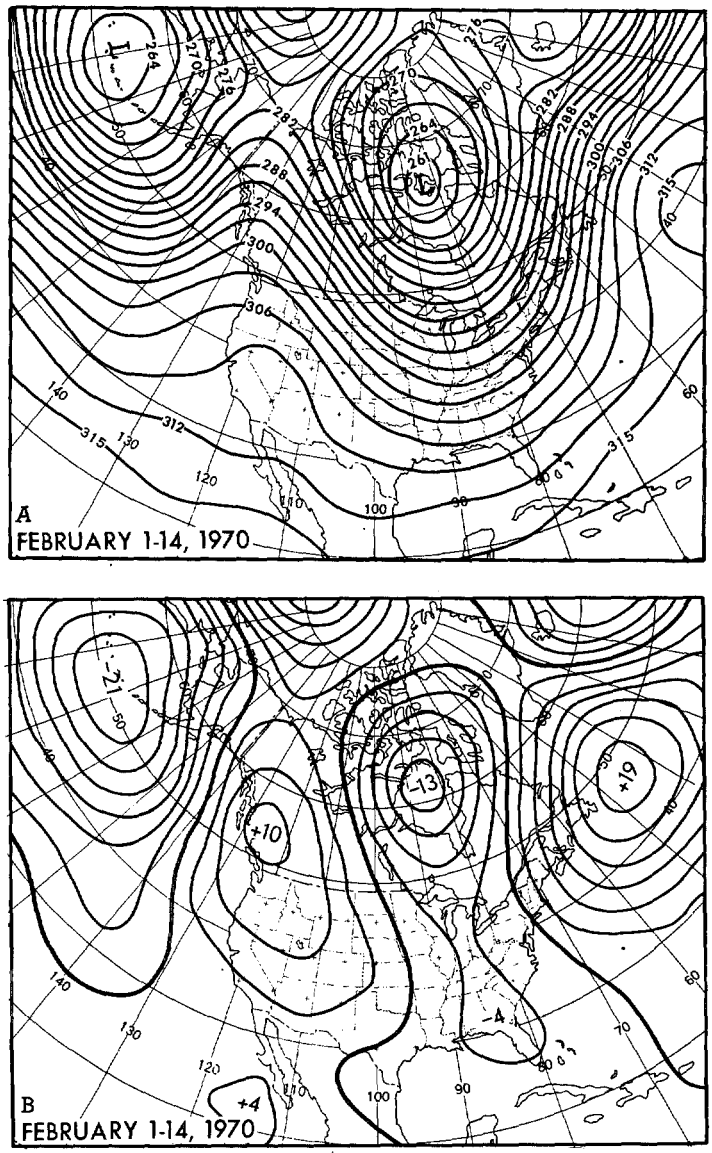


FIGURE 7.—(A) mean 700-mb contours and (B) departure from normal of mean 700-mb height (both in decameters) for Feb. 1–14, 1970.

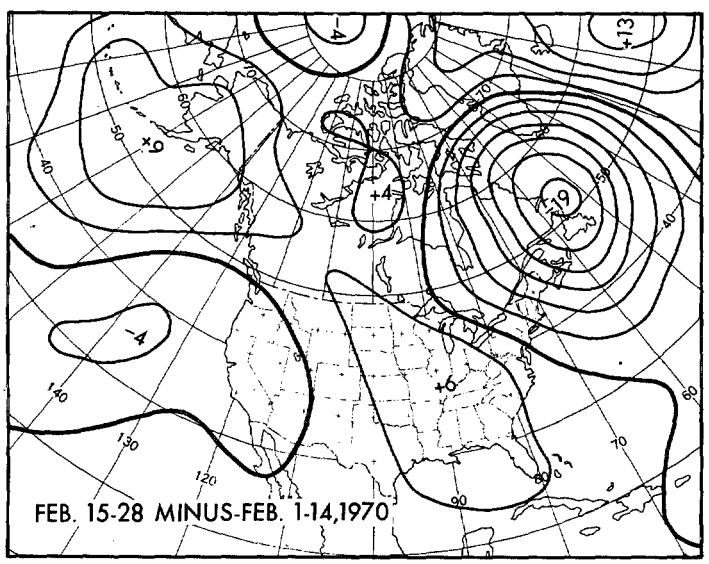


FIGURE 8.—Mean 700-mb height anomaly change (decameters) from Feb. 1–14 to Feb. 15–28, 1970.

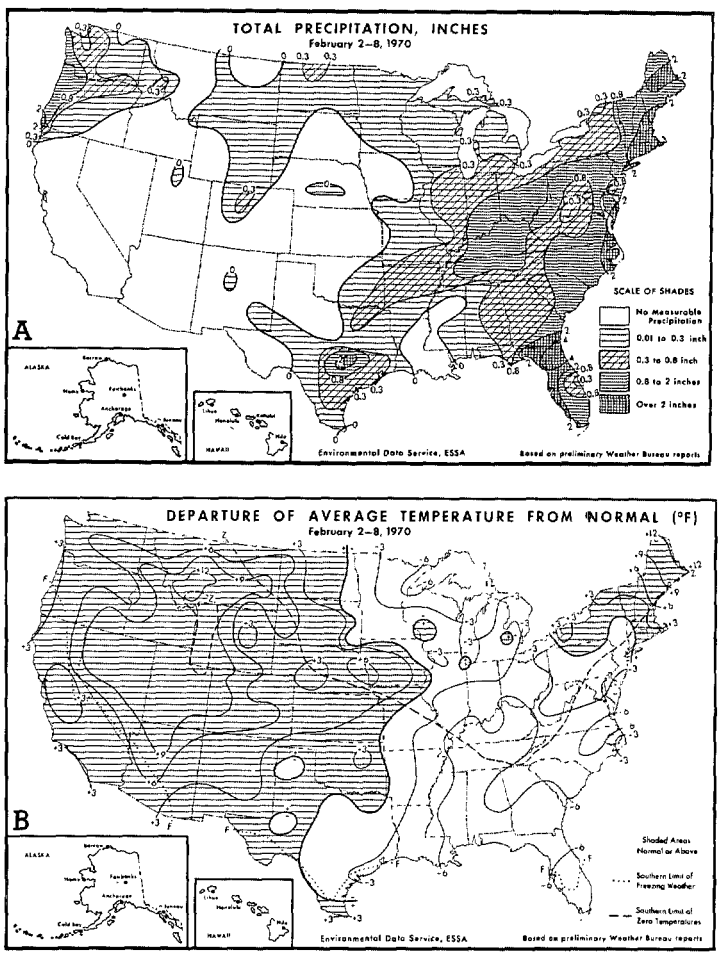


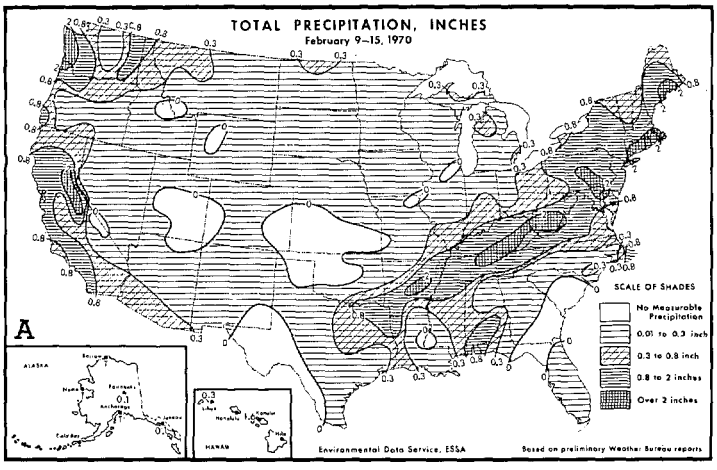
FIGURE 9.—(A) departure from normal of average surface temperature (°F) and (B) total precipitation (inches) for Feb. 2–8, 1970 (from Environmental Data Service 1970*b*).

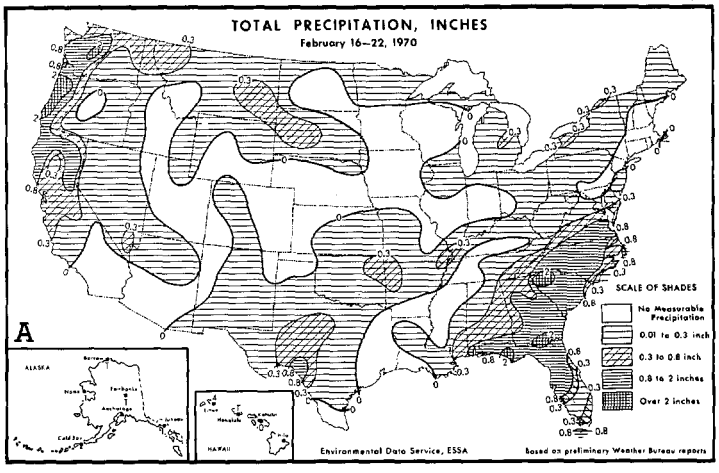
temperatures across the Nation. The circulation in the first half of February (fig. 7) was strongly amplified, with the ridge over western North America as much as 160 m above normal. A deep trough over the eastern half of North America produced heights as much as 130 m below normal near Hudson Bay.

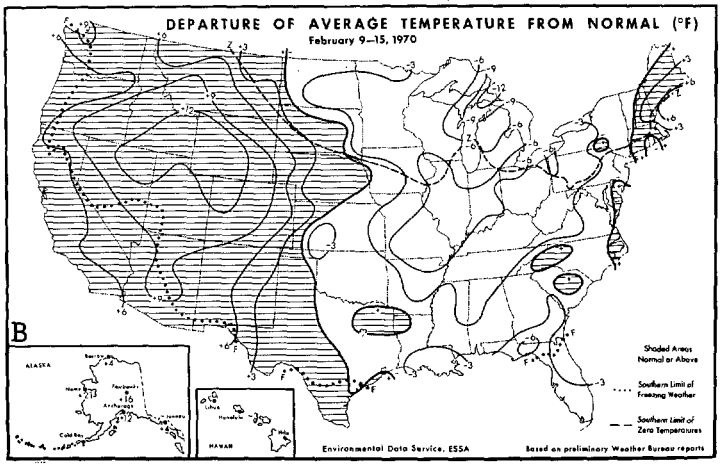
This flow persisted through the last half of February (not shown), with minor changes over the conterminous United States. The height anomaly change from the first half of February to the last half (fig. 8) shows that the principal change over North America was a decrease of as much as 190 m near Labrador. The deepening of this trough tended to broaden the cyclonic curvature into the Atlantic much more than during the first half of February. Slight falls in the Southwest show the increased westerly flow in that area as heights continued to increase over western Canada. So with rises in the trough over the United States and falls in the ridge, some deamplification occurred. At the same time, warming spread eastward from the Far West, with maximum warmth in the Central Plains States the last half of February.

WEEKLY

During the first week of February, temperatures averaged above normal over most of the Northeast and







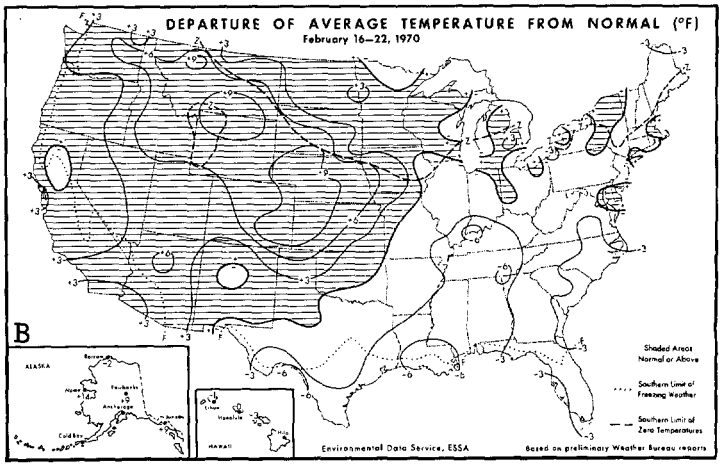


FIGURE 10.—Same as figure 9, except for Feb. 9–15, 1970.

FIGURE 11.—Same as figure 9, except for Feb. 16–22, 1970.

western half of the Nation (fig. 9A). Elsewhere, temperatures were 3°–6°F below normal. Extremely cold air moved into the eastern half of the country at midweek as a major storm swept along the east coast. This storm produced 1–2 in. of rainfall from Florida to New England (fig. 9B) and caused some flooding and wind damage in New England. Winds gusted to 102 mi hr^{-1} at Blue Hill Observatory in Milton, Mass., on the 3d.

The temperature pattern of the second week (fig. 10A) showed little change from the first week, with generally mild weather in the West; in the eastern half of the Nation, temperatures were a few degrees below normal. Coldest area was 6°–12°F below normal from the central Mississippi Valley to the northern Great Lakes. In Alaska, temperatures were 15° to more than 20°F warmer than normal. Barter Island reported a daily temperature departure of 27°F above normal on the 13th. All West Coast States had rainfall this week (fig. 10B) as two daily troughs moved into the West. Principal precipitation in the East occurred as a deepening storm moved from the Ohio Valley eastward to the coast, then northward. This storm left 20 in. of snow in eastern Tennessee, 10–18 in. in central and western Pennsylvania, and more than 10 in. at Mt. Washington, N.H.

Warming spread from the Dakotas to the eastern Great Lakes the third week of February (fig. 11A), with the warmest weather in the northern Rockies and from there to the Central Plains States. Temperatures were well into the middle 80's in western Kansas and the 70's in western Nebraska and eastern Colorado as foehn warming preceded a strong daily upper level trough. Temperatures remained a few degrees below normal in the Southeast and in the Gulf Coast States. Precipitation again fell along the west coast (fig. 11B) from northern California to Washington, related to a westerly flow early in the week and to blocking late in the week. The Southeast received generally similar amounts from a storm early in the week. One exception was Eglin Air Force Base that reported 9.21 in. on Monday.

During the last week of February, warmth covered the western two-thirds of the Nation (fig. 12A) as anticyclonic flow aloft continued in the West. Temperatures moderated to a few degrees below normal in the Southeast but decreased markedly in the Great Lakes; in the Northeast, temperatures fell to 6°–9°F below normal. In midweek, cyclongenesis occurred over the Gulf Coast States associated with an upper level trough that came out of the Southwest. More than 2 in. of rain fell in east

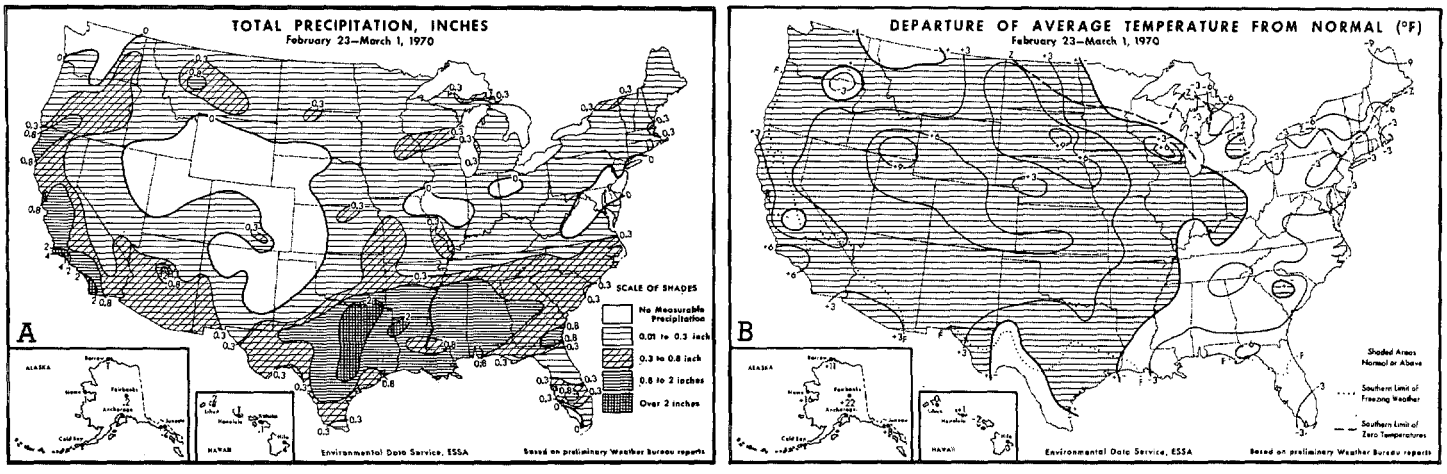


FIGURE 12.—Same as figure 9, except for Feb. 23–Mar. 1, 1970.

Texas (fig. 12B), with lesser amounts from there to the Middle Atlantic States. Cape Hatteras, N.C., reported an inch of snow as this storm passed. A deep storm off the Pacific coast caused 2 in. of rain in some coastal areas of California. As the storm moved inland, precipitation fell in the southwest desert areas, including 1.5 ft of snow at Flagstaff, Ariz., in 24 hr.

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Environmental Data Service, ESSA, *Weekly Weather and Crop Bulletin*, Vol. 57, Nos. 6–10, Feb. 9, 16, 23, and Mar. 2, 9, **1970***b*, pp. 1–12.

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